

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A displacement detecting apparatus comprising:
an illumination system which applies a divergent light beam from a light-emitting device to the a reflection scale provided on a measurement object which relatively moves; and
a light sensing device which detects an amount of a light beam reflected by said reflection scale,

wherein said reflection scale which guides the light beam applied by said illumination system to a direction different from said illumination system and said reflection scale reflects the light beam at least twice to split the light beam to a beam incident into said light sensing device and a light beam which is not incident into said light sensing device by at least two reflections;
and

~~a light sensing device which detects an amount of a light beam reflected by said reflection scale.~~

2. (Original) An apparatus according to claim 1, wherein said reflection scale has an optical function of wavefront-splitting the divergent light beam from said illumination system into a plurality of light beams and overlaying the plurality of wavefront-split light beams at a predetermined position.

3. (Original) An apparatus according to claim 1, wherein said reflection scale has an optical function of wavefront-splitting the divergent light beam from said illumination system into a plurality of light beams and overlaying the plurality of wavefront-split light beams on a detection surface of said light sensing device.

4. (Original) An apparatus according to claim 1, wherein said reflection scale is a roof type reflection element formed by opposing two reflection surfaces at a predetermined angle.

5. (Original) An apparatus according to claim 4, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in a predetermined direction.

6. (Original) An apparatus according to claim 5, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed by a metal reflection surface, and a reflection area thereof is a surface reflection type mirror.

7. (Original) An apparatus according to claim 5, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed by a metal reflection surface, and a reflection area thereof is a surface reflection.

8. (Original) An apparatus according to claim 7, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is an internal reflection type mirror made of a transparent material, and has cylindrical surfaces on the light beam incident and exit surface sides.

9. (Original) An apparatus according to claim 5, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed such that all angles defined by reflection surfaces are equal to each other.

10. (Original) An apparatus according to claim 5, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed such that angles defined by reflection surfaces

continuously increase/decrease from a central portion to a peripheral portion in an array direction of said roof type reflection elements in said reflection scale.

11. (Original) An apparatus according to claim 5, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction.

12. (Original) An apparatus according to claim 11, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction, and a discontinuous portion has a substantially nonreflection characteristic.

13. (Original) An apparatus according to claim 4, wherein said reflection scale is formed such that a ridge formed by joining surfaces of said roof type reflection elements forms part of an arc or ellipse.

14. (Original) An apparatus according to claim 13, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed by a metal reflection surface, and a reflection area thereof is a surface reflection type mirror.

15. (Original) An apparatus according to claim 13, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed by a metal reflection surface, and a reflection area thereof is a rear surface reflection type mirror.

16. (Original) An apparatus according to claim 15, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is an internal reflection type mirror made of a transparent material, and has cylindrical surfaces on the light beam incident and exit surface sides.

17. (Original) An apparatus according to claim 13, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed such that all angles defined by reflection surfaces are equal to each other.

18. (Original) An apparatus according to claim 13, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed such that angles defined by reflection surfaces continuously increase/decrease from a central portion to a peripheral portion in an array direction of said roof type reflection elements in said reflection scale.

19. (Original) An apparatus according to claim 13, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction.

20. (Original) An apparatus according to claim 19, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction, and a discontinuous portion has a substantially nonreflection characteristic.

21. (Original) An apparatus according to claim 4, wherein said reflection scale is formed such that an envelope surface formed by ridges formed by joining surfaces of said roof type reflection elements forms part of a spherical surface.

22. (Original) An apparatus according to claim 21, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed by a metal reflection surface, and a reflection area thereof is a surface reflection type mirror.

23. (Original) An apparatus according to claim 21, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed by a metal reflection surface, and a reflection area thereof is a surface reflection.

24. (Original) An apparatus according to claim 21, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is an internal reflection type mirror made of a transparent material, and has cylindrical surfaces on the light beam incident and exit surface sides.

25. (Original) An apparatus according to claim 21, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed such that all angles defined by reflection surfaces are equal to each other.

26. (Original) An apparatus according to claim 25, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed such that angles defined by reflection surfaces continuously increase/decrease from a central portion to a peripheral portion in an array direction of said roof type reflection elements in said reflection scale.

27. (Original) An apparatus according to claim 21, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction.

28. (Original) An apparatus according to claim 27, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction, and a discontinuous portion has a substantially nonreflection characteristic.